REMARKS

Claims 1-15 are presently in the application.

Reconsideration of the rejection of claims 1, 4, 8-11 and 15 under 35 U.S.C. 102(b) as anticipated by Nakayama et al (JP 07243896A) is respectfully requested.

Claims 1 and 4 have been amended to better distinguish applicants' invention from the cited prior art. Specifically, claim 1 is directed to a device for measuring a level of a fluid in a container with a container bottom, an acoustic guide conduit provided in the container and with at least one ultrasonic transducer disposed close to one end of the acoustic guide conduit for generating ultrasonic pulses and for receiving the ultrasonic pulses reflected in the region of a fluid level in the container, the improvement wherein the acoustic guide conduit (2) comprises a horizontal approach region (11) at said one end of the acoustic guide conduit and disposed close to the container bottom (12). Claim 4 has been amended to depend on claim 1.

In applicants' invention, the horizontal approach region (11) serves to lengthen the transit time of a sound pulse from the ultrasonic transducer (3) to a surface of a liquid and back. This is necessary to detect low fill states, since in low fill states, transit times can occur that are so short that the reflected sound pulse strikes the ultrasonic transducer before the transmitted sound pulse has faded. According to the invention, the sound pulses of the ultrasonic transducer therefore first pass through the horizontal approach region (11) and only then do them arrive in a measurement tube region (16). In this way, it is assured that even at low fill states, an exact determination of the transit time from the transmission of the sound pulse until the reception of the reflected sound pulse is possible.

Claim 1 is not anticipated by Nakayama et al because the reference fails to disclose an acoustic guide conduit comprising a horizontal approach region at the one end of the acoustic guide conduit nearest the ultrasonic transducer and disposed close to the container bottom. In Nakayama et al, the only horizontal region of the sonic tube 17 (generally indicated at reference numeral 20) disposed close to the container bottom is at the end of the sonic tube most distant from the transducer. This horizontal region 20, however, does not serve the purpose of guiding sound but rather only supports the spiral conduit 17 on the container bottom, since the sound pulses coming from the direction of the ultrasonic transducer 13 are reflected at the surface 22 of the liquid and do not even reach the liquid filled conduit portion 17.

In Nakayama et al, the ultrasonic transducer 13 is provided on the container top, not on the container bottom. As a result, the sound pulses transmitted from the ultrasonic transducer 13 do not move in a liquid as in the subject of applicants' claim 1, but rather solely in gas. Because of the spiral embodiment of the sonic tube 17, the transit time of the sound pulses from the top down to a minimal fill state are so long that the intensity of the reflected sound pulses is so slight that high measurement precision is unattainable. The location of the ultrasonic transducer 13 on the container top moreover has the disadvantage that above the surface of the liquid, sloshing motions of the fuel can create foam, which does not reflect the sound pulses or at the least reflects them in adulterated form.

The subject matter of claim 1 is distinguished over Nakayama et al in that the acoustic guide conduit (2) has an approach region (11) which lengthens the transit time of the sound pulses, on its end toward the ultrasonic transducer 13. In addition, the ultrasonic transducer 13

is provided on the container bottom, not on the container top. Thus, the invention attains the stated objectives of improving the measurement precision at low fill states in a container.

To support a rejection of a claim under 35 U.S.C. 102(b), it must be shown that each element of the claim is found, either expressly described or under principles of inherency, in a single prior art reference. See Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984).

Nakayama et al does not teach a device for measuring a level of a fluid in a container with a container bottom of the type recited in claim 1 in which the acoustic guide conduit includes a horizontal approach region at the one end of the acoustic guide conduit nearest the ultrasonic transducer and which is disposed close to the container bottom. Accordingly, claim 1 and claims 4, 8-11 and 15, dependent on claim 1, are not anticipated by Nakayama et al.

Reconsideration of the rejection of claims 1, 2, 4, 8-11, 14 and 15 under 35 U.S.C. 102(b) as anticipated by Dyke (US 5,172,594) is respectfully requested. The examiner reads the "acoustic guide conduit" of claim 1 on both the stillwell 20 and the wire bus conduit 28 shown in Dyke. However, the conduit 28 is not an acoustic guide conduit. As explained in Dyke, in order to determine the height of liquid inside the tank, a conventional ultrasonic transducer assembly indicated at 18 (FIG. 3) is mounted in the bottom of a conventional stillwell 20. The transducer assembly 18 is connected by means of a wire bus 22 to a conventional fuel quantity indicator system located outside of the tank. The transducer operates in a conventional manner by emitting a signal upward within the stillwell 20 (FIG. 1). The signal is reflected from the top surface of the liquid back downward to the transducer. The transducer assembly 18 is positioned inside the locating cylinder 26 such that the transducer extends into the stillwell 20. The wire bus

22 is located inside a guide conduit 28 which is connected to an end of an end sleeve 27 by a connector. The guide conduit 28 is connected to the tank sidewall 12 by a coupling assembly indicated at 30. In turn, the wire bus 22 extends through the sidewall 12 at an opening 31 in the sidewall where it terminates at a male sensor connector 34 which is located outside the tank. Attached to the sensor connector 34 is a female fitting 35 (FIG. 2) having wires 36 which lead to the fuel quantity indicator system. When it is necessary to change the transducer and/or wire bus, the liquid inside the tank is lowered to a level below the sidewall opening 31 (FIG. 4). Following this, a retaining connector 37 is unscrewed from the coupling assembly 30 to uncover sensor connector 34. The transducer assembly 18 and wire bus 22 are then removed from the tank by simply engaging the wire bus at a location outside of the tank and pulling the wire bus and attached transducer assembly out of the locator cylinder 26 and through the conduit 28. Once the repair has been completed, the transducer assembly is re-inserted into the conduit and pushed through the guide conduit 28 by means of the attached wire bus 22 until the transducer assembly is positioned within the stillwell 20 as shown in FIG. 4.

Thus, it should be clear to anyone having read the disclosure found in the Dyke reference that the tube 28 is not an acoustic guide conduit, but rather a conduit provided for the purpose of facilitating the installation and removal of the transducer assembly 18 from within the tank 10. The only acoustic guide conduit disclosed in Dyke is the stillwell 20.

Dyke does not teach a device for measuring a level of a fluid in a container with a container bottom of the type recited in claim 1 in which the acoustic guide conduit includes a horizontal approach region at the one end of the acoustic guide conduit nearest the ultrasonic

transducer and which is disposed close to the container bottom. Accordingly, claims 1, 2, 4, 8-11, 14 and 15 are not anticipated by Dyke.

Reconsideration of the rejection of claims 3 and 5-7 under 35 U.S.C. 103(a) as unpatentable over Dyke in view of Sato et al (JP 05273033A) is respectfully requested. Dyke is specifically directed to structure permitting the removal and replacement of the transducer from the lower end of the stillwell 20, located within the interior of the tank 10. Thus, mounting the transducer assembly 18 on the sidewall of Dyke's tank 10, as suggested by the examiner, would have been contrary to the very objectives achieved by Dyke's invention. Therefore, one of ordinary skill in the art would not have combined the teachings of Sato with those of Dyke.

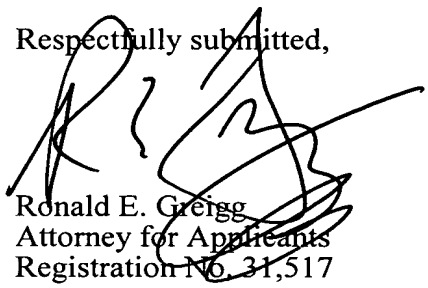
Furthermore, to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Neither Dyke nor Sato et al teaches or suggests a device for measuring a level of a fluid in a container with a container bottom of the type recited in claim 1 in which the acoustic guide conduit includes a horizontal approach region at the one end of the acoustic guide conduit nearest the ultrasonic transducer and which is disposed close to the container bottom. Accordingly, claims 3 and 5-7 are not rendered obvious by the combined teachings of Dyke and Sato et al.

Reconsideration of the rejection of claims 12 and 13 under 35 U.S.C. 103(a) as unpatentable over Dyke in view of Stapleton et al (US 5,085,077) is respectively requested. Neither Dyke nor Stapleton et al teaches or suggests a device for measuring a level of a fluid in a container with a container bottom of the type recited in claim 1 in which the acoustic guide

conduit includes a horizontal approach region at the one end of the acoustic guide conduit nearest the ultrasonic transducer and which is disposed close to the container bottom. Accordingly, claims 12 and 13 are not rendered obvious by the combined teachings of Dyke and Stapleton et al.

Entry of the amendment and allowance of the claims is respectfully requested.

Respectfully submitted,



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